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AIP report MANPOWER STATISTICS DIVISION

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EMPLOYMENT SURVEY 1983

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Although the early 1980's are generally associated with fluctuating employment opportunities for new graduates, physics graduates experienced a relatively stable, but gradually increasing, demand for their services. This observation is based on a year-by-year comparison of how much time physics degree recipients require to secure initial employment. Two surveys conducted by AIP each summer identify the career goals of physics graduates at three degree levels—doctoral, master's, and bachelor's—and single out the employment-oriented graduates. In order to allow at least six months for the degree recipients to find positions we schedule the Employment Survey for December of each year and focus not only on descriptions of initial employment, but also on how long it took each graduate to obtain such employment.

Highlights of this report are:

- More physicists secure potentially permanent employment in a shorter time than in the previous year.
- More doctoral physicists find permanent employment in the subfield of their dissertations.
- Foreign graduates no longer get shorter 'postdocs'.

Figure I presents four time periods during which graduates at each of three degree levels accepted employment. 'Postdocs'

Fig. I. Time spent by 1983–84 physics degree recipients in securing employment.

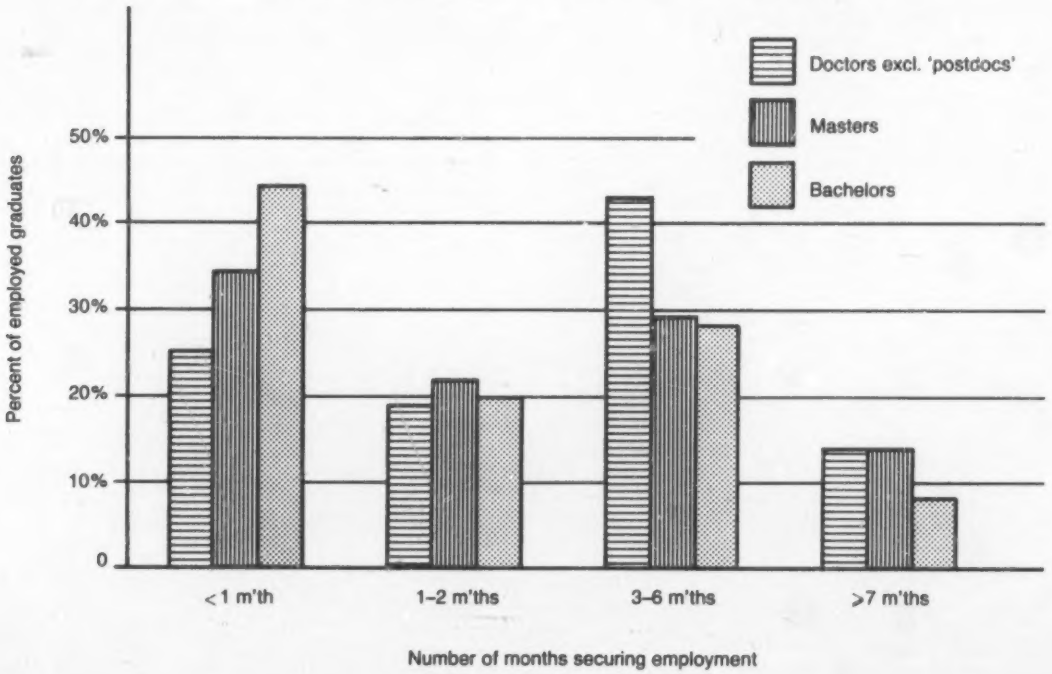

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Table I. Changes in occupational status of physics degree recipients between the summer of 1983 and the following winter.

Employment status reported by physics degree recipients, summer 1983	Occupational status, winter 1983–84						
		'Postdoc' or student	Employed full-time permanent	Employed part-time temporary other	Not employed and seeking	Total N	Total %
Doctors							
Newly accepted empl.		16	175	1	–	192	38
Continuing employment		3	31	1	1	36	7
'Postdoc'		199	20	–	–	219	44
Return to foreign country		3	6	4	1	14	3
Other		1	1	5	8	15	3
Not empl. and seeking		10	11	3	2	26	5
Total respondents	N	232	244	14	12	502	
	%	46	49	3	2		100%
Masters							
Newly accepted empl.		7	59	–	2	68	47
Continuing employment		–	23	–	4	27	19
Return to foreign country		2	3	–	2	7	5
Other		1	7	3	3	14	10
Not empl. and seeking		1	19	–	8	28	19
Total respondents	N	11	111	3	19	144	
	%	8	77	2	13		100%
Bachelors							
Newly accepted empl.		5	355	3	7	370	49
Continuing employment		1	96	1	2	100	13
Military service		–	104	–	2	106	14
Volunteer or temporary		4	5	2	–	11	1
Will be seeking		4	71	1	21	97	13
Not empl. and seeking		2	43	1	28	74	10
Total respondents	N	16	674	8	60	758	
	%	2	89	1	8		100%

are excluded from the doctoral graduates so as to focus on potentially permanent positions comparable to those sought by the masters and bachelors. The first time period—< 1 month—includes all the degree recipients who had positions lined up at the time of graduation. At each degree level a larger proportion of graduates than in the previous year found positions during this brief period. But, similar to prior years, most of the new doctoral physicists require at least three months to secure employment whereas most non-doctoral physicists secure initial employment in three months or less.

Tables I and **II** compare the occupational status the graduates reported in the summer of 1983 with that reported during the following winter. **Table I** makes that comparison for the physics graduates and shows, among other things, that the percentage of doctorate recipients seeking employment decreased from five to two. Comparable decreases in unemployment, recorded for masters and bachelors, were from nineteen to thirteen and from ten to eight, respectively.

The largest group of the astronomy graduates are the doctorate recipients as indicated in **Table II** and all of them held positions at the time of the two surveys.

Table II. Changes in occupational status of astronomy degree recipients between the summer of 1983 and the following winter.

Employment status reported by astronomy degree recipients, summer 1983

Doctors		Occupational status, winter 1983–84: 'Postdoc' or student	Full-time employed	Employed part-time temporary other	Not employed and seeking	Total N	Total %
Full-time employment		1	9	1	–	11	27
'Postdoc'		24	2	2	–	28	68
Other		1	–	1	–	2	5
Total respondents	N	26	11	4	–	41	
	%	63	27	10	–		100%
Masters							
Newly accepted employment		–	5	–	–	5	71
Continuing employment		1	1	–	–	2	29
Not employed and seeking		–	–	–	–	–	–
Total respondents	N	1	6	–	–	7	
	%	14	86	–	–		100%
Bachelors							
Full-time employment		–	7	–	–	7	47
Temporary employment		–	–	–	1	1	7
Not employed & seeking		1	4	1	1	7	46
Total respondents	N	1	11	1	2	15	
	%	7	73	7	13		100%

Doctoral physicists and astronomers

Traditionally, physicists whose dissertations were based on experimental work are more likely to be offered potentially permanent employment; theoreticians, on the other hand, were more likely candidates for 'postdocs'. However, the most recent year, 1983–84, for which these data were collected points to a substantially different pattern. The two major changes affecting this pattern are: 1) a greater demand for U.S. doctoral physicists and 2) an increase in the proportion of foreign physicists who remain in the United States for their initial employment. **Table III** thus separates doctoral graduates by type of doctoral research and citizenship. A three-to-one ratio among U.S. citizens of experimentalists to theoreticians coupled with an increasing demand for them results in a majority of theoreticians (56%) as well as experimentalists (53%) being offered potentially permanent employment. Foreign graduates are still most likely to take temporary postdoctoral positions.

Table III. Occupational status of experimental and theoretical physicists by type of dissertation research, 1983–84*.

Occupational status		Experimentalists U.S.	Experimentalists Foreign	Experimentalists Total	Theoreticians U.S.	Theoreticians Foreign	Theoreticians Total
Full-time employed		53%	26%	49%	56%	24%	45%
'Postdoc'		44	68	47	40	76	51
Other		1	3	1	2	–	2
Unemployed & seeking		2	3	3	2	–	2
		100%	100%	100%	100%	100%	100%
Total	N	242	38	280	83	38	121
	%			70			30

*63 Doctors did not specify type of research.

Table IV. Characteristics of postdoctoral and full-time employed physics and astronomy doctorate recipients, 1982–83.

Characteristics	Physics 'Postdocs'	Physics Full-time employed	Astronomy 'Postdocs'	Astronomy Full-time employed	Characteristics
Sex					Sex
Female	8%	6%	8%	36%	Female
Male	92	94	92	64	Male
Age					Age
26 or younger	8%	4%	4%	–	26 or younger
27 years	13	10	15	–	27 years
28 years	20	12	12	9%	28 years
29 years	23	19	54	45	29 years
30 years	13	16	8	9	30 years
31–32 years	9	18	4	9	31–32 years
33 or older	14	21	3	28	33 or older
Citizenship					Citizenship
U.S.	71%	89%	92%	100%	U.S.
Foreign	29	11	8	–	Foreign
Type of research					Type of research
Experimental	68%	71%	77%	91%	Observational
Theoretical	32	29	23	9	Theoretical
Major subfields of dissertation					Subfields of dissertation
			16%	–	Astrophysics
Astrophysics	6%	5%	24	20%	Cosmology, extragalactic, quasi-stellar objects
Electron, atomic & molec.	6	12	4	–	Galactic structure, stellar motions
Elementary particles	19	11	16	20	Stellar atmospheres & spectra, stellar evolution, solar & stellar interiors
Nuclear	9	7			
Optics	3	6	16	10	Interstellar matter & gaseous nebulae
Plasma, fluids	3	9	12	10	Solar system
Solid state	32	32	12	40	Other subfields
Number of respondents	232	244	26	11	

Having distinguished between the two types of initial employment for new doctoral physicists, **Table IV** presents a further analysis of the type of employment by comparing physicists with astronomers. In this analysis five characteristics are examined, of which three (age, citizenship, and type of research) were found to be consistently influential. For example, both astronomers and physicists who accepted 'postdocs' were younger, included more foreign citizens, and tended to be theoreticians. In regard to physics subfields, when one considers the attention given to the development of new sources of energy it is not surprising that plasma physicists are likely to be offered permanent positions, whereas elementary particle physicists tend to be offered 'postdocs'.

The ratio of doctorates conferred on physicists to those conferred on astronomers is approximately ten-to-one, and the respondents from these groups form the same ratio. The questions directed at these two groups of graduates are similar, which account for the parallel analyses presented in **Tables I, II** and **IV**. However, a more detailed examination of the characteristics is no longer meaningful for so small a group as the astronomers comprise. Thus **Figure II** includes only physicists, and explores further the difference between 'postdocs' and those with potentially permanent employment.

Postdoctoral fellowships are both temporary and low paying but these drawbacks are offset by giving the graduates the opportunity to continue the research of their dissertations or related areas of their choosing. And, as shown in **Figure II**, 75% of the new 'postdocs' fell into that category because they "specifically sought" these fellowships. On the other hand, this voluntary group is not as predominant as it had been in the previous two years when it represented 78% and 83% of the 'postdocs'.

The survey questions, addressing those who had accepted potentially permanent positions, focus on how closely their work is related to their education; in this respect **Figure II** indicates a change from the previous year by showing that 50% of these new physicists worked in the subfields of their dissertations. Only 37% did so in the previous year. The proportion of new physicists who enter new areas of research unrelated to physics has remained relatively constant.

Continuing the comparison between 'postdocs' and graduates with potentially permanent positions **Table V** focuses on the subfield mobility experienced by each group. The table lists the dissertation subfields most frequently chosen by the doctoral candidates and matches them against the subfields associated with the physicists' initial employment. Thus the proportion of graduates who remain in the same subfield is considerably higher for those who accepted 'postdocs' (95% for elementary particle physicists and 87% for solid state physicists) than for those in potentially permanent positions (47% for solid state physicists, or 65% for plasma physicists). Adaptability versus specialization is another question to which **Table V** may offer some answers. For example, those who specialized in electron, atomic or molecular physics accepted initial employment in at least six other subfields according to **Table V.**

Fig. II. Employment status of 1983–84 doctoral physicists 6–18 months after graduation.

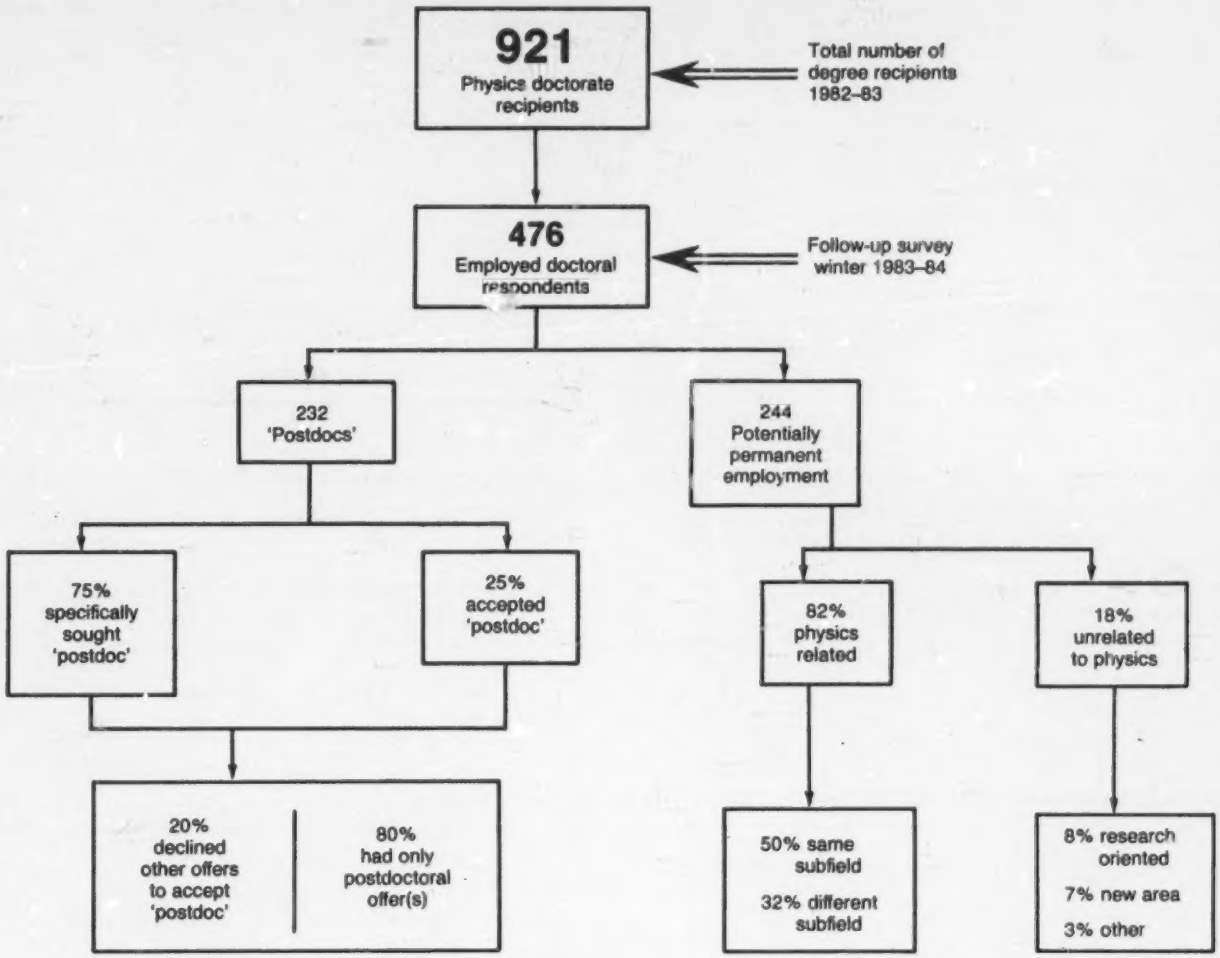

Table V. Subfield mobility of doctoral level physicists, 1982–83.

Major subfields of dissertations	Subfields of 'postdoc'							
	Bio/geophysics	Electron, atomic & molecular	Elementary particles	Mathematical physics	Nuclear	Solid state	Other	Total respondents
Bio/geophysics	79%	5%	–	–	–	11%	5%	19
Electron, atomic & molec.	19	57	–	–	–	–	24	21
Elementary particles	–	–	95%	–	–	–	5	39
Mathematical physics	–	–	23	59%	6%	12	–	17
Nuclear	4	–	13	4	79	–	–	24
Solid state	1	1	–	–	1	87	10	77
								197

Major subfields of dissertations	Subfields of potentially permanent employment									
	Astrophysics	Electron, atomic & molecular	Geophysics	Optics	Plasma, fluids	Solid state	Applied physics	Education	Other	Total respondents
Astrophysics	64%	–	–	–	9%	–	–	9%	18%	11
Electron, atomic & molec.	–	35%	5%	20%	–	10%	15%	5	10	20
Optics	–	–	–	64	9	18	9	–	–	11
Plasma, fluids	–	–	12	–	65	–	18	–	5	17
Solid state	–	2	5	12	3	47	15	5	11	59
										118

Table VI. Factors influencing the length of postdoctoral fellowships for 1982–83 doctoral level physicists.

Characteristics			Length of 'postdoc' <1 yr.	1.5 to 2 yrs.	>2 yrs.	Total reporting %	N
Citizenship	U.S.		34%	57%	9%	100%	168
	Foreign		35	54	11	100	64
Selected subfields of Ph.D.	Electron, atom., molec.		26%	68%	6%	100%	19
	Elementary particles		26	56	18	100	34
	Nuclear		25	55	20	100	20
	Solid State		38	61	1	100	71
Plan	Specifically sought 'postdoc'	Yes	29%	61%	10%	100%	175
		No	51	45	4	100	57
	Total respondents	N	80	130	22		232
		%	34	56	10	100%	

Having emphasized the fact that 'postdocs' are temporary, let us examine this attribute in greater detail by assigning three ranges to the lengths of postdoctoral fellowships. Very few 'postdocs' are offered for less than one year which is why they are combined with those offered for one year. The majority of 'postdocs' is offered for approximately two years as shown in **Table VI**, and only 10% of these fellowships specify a period of more than two years.

Table VI examines possible characteristics of the graduates that might influence the lengths of their fellowships. For the class of 1983, neither citizenship nor the dissertation subfield,

Table VII. Employment with potential permanence accepted by 1982–83 doctorate recipients.

		Type of employer Univ.	4-yr. coll.	Industry	Gov't	FFRC	Other	Total N	%
Subfield of Ph.D	Cross disciplinary	10	4	6	1	2	2	25	10
	Elec., atomic, molec.	4	1	11	9	1	3	29	12
	Elem. particles	11	3	12	1	1	1	29	12
	Nuclear	3	1	6	4	3	–	17	7
	Optics	2	–	7	1	2	1	13	5
	Plasma	3	1	10	4	2	–	20	8
	Solid state	13	4	41	15	6	6	85	35
	Other	5	1	11	3	5	1	26	11
Work activity	Teaching	8	4	1	–	–	–	13	5
	Research	16	1	16	18	12	4	67	27
	Teaching & research	23	10	–	1	–	–	34	14
	Res./dev./design	4	–	70	16	8	4	102	42
	Computer science	–	–	7	2	1	1	11	5
	Other	–	–	10	1	1	5	17	7
Physics related work	Same subfield	33	7	42	21	12	5	120	49
	Different subfield	18	8	31	12	7	4	80	33
Unrelated to physics	Research-oriented	–	–	11	4	2	2	19	8
	New area	–	–	16	1	–	2	19	8
	Other	–	–	4	–	1	1	6	2
Interested in a job change	Yes	13	3	22	3	8	3	52	21
	No	34	11	71	33	12	10	171	70
	Unsure	4	1	11	2	2	1	21	9
	Total respondents N	51	15	104	38	22	14	244	
	Total respondents %	21	6	43	15	9	6		100%

with the possible exception of solid state, appeared to influence the lengths of the 'postdocs' offered. This observation represented a change from the previous year when foreign graduates were more likely to be offered shorter 'postdocs'. The third factor listed in **Table VI** does influence the length of the fellowship; graduates who specifically sought 'postdocs' appeared to get those which lasted two years or longer. On the other hand, a majority of the graduates who accepted 'postdocs' because they were unable to secure permanent positions, were offered one-year fellowships.

Since the questionnaire for this survey reaches the new physicists anywhere from six to eighteen months after graduation, it seemed appropriate to request an evaluation of his or her initial employment. The answers to these questions, addressing the doctorate recipients, are summarized in **Table VII** and related to five distinct types of employers. When compared with the previous year's data, a shift away from industry and toward the government as an employer can be observed.

A question concerning the desirability of a job change within two years was answered with "no" by 70% of the respondents; only 62% and 59% gave negative responses one and two years ago, respectively.

New physics masters

To supplement the overall comparison among degree recipients shown in **Figure I, Table VIII** focuses only on new physics masters and examines the possibility that any of six characteristics may influence the "time spent finding employment". The first category on the time scale, "< 1 month" includes all those who studied on a part-time basis and continued to work for the same employer who helped finance the education. Half of the masters age 29 or older fall into this time category but only one quarter of the younger masters are part of this group.

The characteristics of type of employer and work activity also appear to be influential. For example, teaching positions in colleges or universities need to be arranged well in advance of the academic year, in contrast to an industrial position which can be offered year-round.

While masters who took positions unrelated to physics found them in a briefer period of time than those accepting physics positions, it should be noted that 85% of the new masters were able to locate physics-related employment, the majority within two months.

Table VIII. Characteristics of 1982–83 physics masters that influence the time required to secure employment.

Characteristics		Time spent finding employment					Total	
		< 1 mo.	1–2 mos.	3–6 mos.	7–12 mos.		N	%
Sex	Female	40%	20%	40%	–	100%	10	9%
	Male	34	22	28	16%	100	104	91
Age	23 or younger	–	33%	33%	34%	100%	3	3%
	24 years	21%	36	36	7	100	14	12
	25 years	30	26	39	5	100	23	20
	26 years	21	29	29	21	100	14	12
	27–28 years	36	23	23	18	100	22	19
	29 or older	50	11	24	15	100	38	34
Type of graduate institution	Doctorate-granting	31%	26%	29%	14%	100%	92	81%
	Master's-granting	45	9	32	14	100	22	19
Type of employment	Physics related	35%	20%	33%	12%	100%	97	85%
	Unrelated to physics	38	31	12	19	100	17	15
Major employer	Industry	25%	24%	36%	15%	100%	59	52%
	Gov't/military	32	21	37	10	100	19	17
	Coll./univ.	48	22	17	13	100	23	20
Major work activity	Teaching	55%	20%	10%	15%	100%	20	18%
	Res., dev. or design	28	21	38	13	100	63	55
	Data analysis	46	8	38	8	100	13	11
Total respondents	N	40	25	33	16		114	
	%	35	22	29	14			100%

Table IX. Characteristics of 1982–83 physics bachelors that influence the time required to secure employment.

Characteristics		Time spent finding employment: <1 mo.	1–2 mos.	3–6 mos.	7–12 mos.		Total: N	%
Sex	Female	45%	26%	20%	9%	100%	102	15%
	Male	44	19	29	8	100	580	85
Age	21 or younger	47%	33%	20%	–	100%	18	3%
	22 years	49	17	28	6%	100	280	41
	23 years	42	21	27	10	100	164	24
	24–25 years	35	20	31	14	100	95	14
	26–29 years	42	19	33	6	100	70	10
	30 or older	47	27	20	6	100	55	8
Type of bachelor's institution	Doctorate-granting	44%	19%	29%	8%	100%	266	39%
	Master's-granting	42	20	31	7	100	102	15
	Bachelor's-granting	45	20	26	9	100	314	46
Type of employment	Physics related	42%	22%	29%	7%	100%	430	63%
	Unrelated to physics	50	16	25	9	100	252	37
Region of bachelor's institution	Northeast	41%	21%	29%	9%	100%	212	31%
	Southeast	50	20	24	6	100	123	18
	Midwest	43	17	33	7	100	136	20
	Southwest & Mountain	48	12	25	15	100	75	11
	Pacific	43	25	26	6	100	136	20
Major work activity	Res., dev. or design	45%	22%	29%	4%	100%	239	35%
	Programming	36	22	34	8	100	246	36
	Quality control	39	22	31	8	100	123	18
Total respondents	N	300	136	191	55		682	
	%	44	20	28	8			100%

New physics bachelors

When examining the physics bachelors we find that in recent years a steadily rising proportion of them have employment lined-up upon graduation. In 1983 that proportion reached 44% and the graduates suggested that characteristics such as sex, age, type of institution, type of employment, or region of the country did little to influence that time scale. However, for those who spent between one and six months to secure employment, the geographic region and the type of work did have some influence on the time involved, as shown in **Table IX**. The graduates from the Southwest and Mountain regions included a larger percentage of bachelors who sought employment for more than six months than those from other parts of the country.

New astronomy bachelors

Each year only a small number of new astronomy bachelors choose immediate employment instead of graduate study. Consequently the number of graduates who responded to two surveys and gave employment information in the winter of 1983–84 was low, only 13, as shown in **Table X**. In previous years a majority of the astronomy bachelors accepted positions in industry, whereas more 1983 graduates found employment in educational institutions, making the median salary lower than in the previous year by $150 per month.

Table X. Employment of 1982–83 astronomy bachelors.

Work activity	Industry	Gov't incl. military	Educational institution	Total N	Median monthly salary
Data analysis	1	2	4	7	
Development or design	1	–	1	2	
Teaching	–	1	–	1	$1400
Other	2	–	1	3	
Total respondents	4	3	6	13	